AIR STAGED CATALYTIC COMBUSTION SYSTEM

ABSTRACT OF THE DISCLOSURE

[027] A system and method of combusting a hydrocarbon fuel is disclosed. The system and method combines the accuracy and controllability of an air staging system with the ultra-low emissions achieved by catalytic combustion systems. The present invention can achieve ultra-low emissions while maintaining the combustion system pressure drop constant over a wide range of power levels, with essentially no consequent impact on engine efficiency. Also, the present technology is easily applied to a multitude of different systems, such as conventional lean operating catalysts. One aspect of the invention is a system for combusting hydrocarbon fuel, which includes an air supply for supplying air from a compressor to the air inlet, an air inlet for entrance of an air mixture from the compressor, at least one air staging valve that directs air to a catalyst module and a bypass manifold. The catalyst module receives fuel and air, which mixes with a catalyst contained therein. The catalyst partially oxidizes the fuel to generate a heat of reaction and a partial oxidation product stream comprising hydrogen and carbon oxides. The fuel and air from the catalyst module is then delivered to a main combustor that is capable of completely combusting the partial oxidation product stream to generate an effluent gas stream. The system may also contain at least one preheater combustor, which is upstream from the catalyst module and downstream from the air staging valve. The result is a system and method that offers ultra-low emissions over a wide range of power levels, fuel properties and ambient operating conditions.